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AMINOPHOSPHONATE HERBICIDES

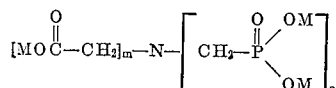
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No Drawing. Continuation of application Ser. No. 481,940, Aug. 23, 1965. This application June 25, 1968, Ser. No. 742,963

Int. Cl. A01n 9/36; C07f 9/38
U.S. Cl. 71-86

34 Claims

ABSTRACT OF THE DISCLOSURE

Phytotoxic method employing compounds of the formula

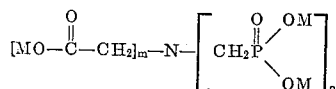


wherein M is selected from the class consisting of alkali metal, hydrogen, alkyl of up to four carbon atoms, ammonium, alkyl substituted ammonium wherein the alkyl moiety has up to four carbon atoms, and wherein m and n are each integers from one to two, provided that the sum of n and m is three.

This application is a continuation of application Ser. No. 481,940 filed Aug. 23, 1965, now abandoned.

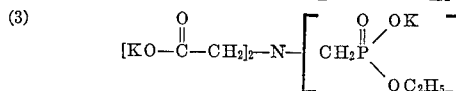
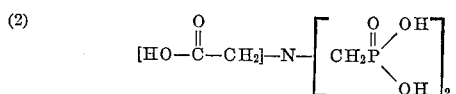
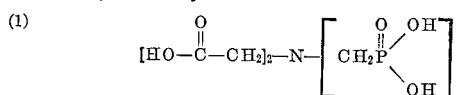
This invention relates to a novel procedure for inhibiting the growth of unwanted plants. The invention is particularly directed to the use of a class of compounds which have selective phytotoxicity on grasses and other noxious weeds. The procedure is particularly effective in destroying established weeds.

It has been found that a class of compounds not previously known to possess phytotoxic properties are particularly useful as selective toxicants when applied to leaves, stems, roots and other parts of living plants. The useful compounds have the general formula



wherein m and n are integers from one to two provided that the sum of m and n is three; and wherein M is selected from the class consisting of alkali metal, hydrogen, alkyl having up to four carbon atoms, ammonium and alkyl substituted ammonium wherein the alkyl moiety has up to four carbon atoms. The useful class of compounds also includes those wherein the several M groups are the same or different. Of particular utility are those compounds wherein some or all of the M substituents are hydrogen, in which case more enhanced activity was observed. The formulation procedure is facilitated if acids, acid salts, or salts are used, because of the ready water dispersibility of the toxicants.

The following compounds have been found to have useful phytotoxicity:

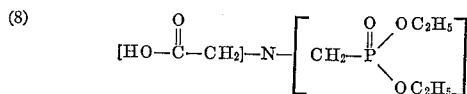
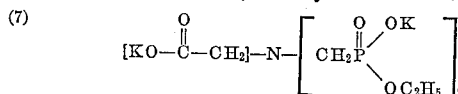


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(4) tris(dimethyl ammonium)iminodiacetate N - methyl phosphonate (dimethylamine salt of (1))

(5) trisodium iminodiacetate N - methyl phosphonate (sodium salt of (1))

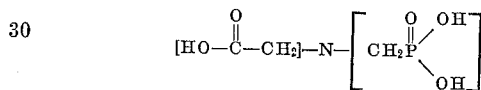
(6) tetra(dimethyl ammonium)aminoacetate N,N - bis-methyl phosphonate (dimethyl amine salt of (2))



METHOD OF PREPARATION

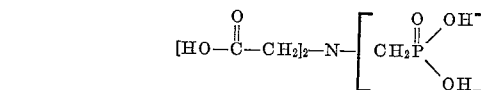
Example 1

A reaction vessel provided with a stirring mechanism and a reflux condenser was charged with 750 parts by weight of 50% aqueous glycine, 750 parts by weight of 38% orthophosphorous acid, and 500 parts of 38% hydrochloric acid. While stirring the mixture continuously it was heated to 100° C., then 1500 parts of aqueous formaldehyde solution were added gradually over a period of 30 minutes. The reflux condenser was removed and mixture concentrated to evaporate 25% of its volume over a two-hour period. The reaction product was identified as being:



Example 2

A reaction vessel provided with a stirring mechanism and a reflux condenser was charged with 169 parts by weight of amino diacetic acid hydrochloride, 82 parts of orthophosphorous acid, and 50 parts of concentrated hydrochloric acid (38%). The mixture was heated to 100° C. and 200 parts of 37% aqueous formaldehyde were added gradually over a 30-minute period. The resulting solution was maintained at about 100° C. for one hour and 50 parts of p-formaldehyde were then added slowly over a 15 minute period. The resulting product was refluxed for an additional 2 hours. The product was then evaporated in a steam bath to about 1/3 of its volume and dissolved in hot ethanol. A product was precipitated by the addition of hydrochloric acid and was identified as N,N-diacetic acid aminomethylene phosphonic acid having the formula:



The acids described in the above examples have pronounced phytotoxicity, and derivatives of these acids, such as alkali metal salts, amine and ammonium salts, are also effective. These salts are prepared by neutralizing the acids entirely or in part with suitable alkaline reagents or organic bases.

Although the novel procedure of the present invention encompasses treatment of soil surfaces wherein seeds are germinating and the plants emerging, the compounds are especially useful in destroying or inhibiting the growth of established plants. The surfaces of the soil or of the growing plant parts are sprayed or otherwise treated so as to apply a phytotoxic quantity of the above described active compounds. Compositions suitable for the practice of this invention may be aqueous solutions or dispersions. Generally, concentrations of about 0.01 to about 0.5 percent by weight are suitable for this application. The formulations are applied at rates sufficient to provide a